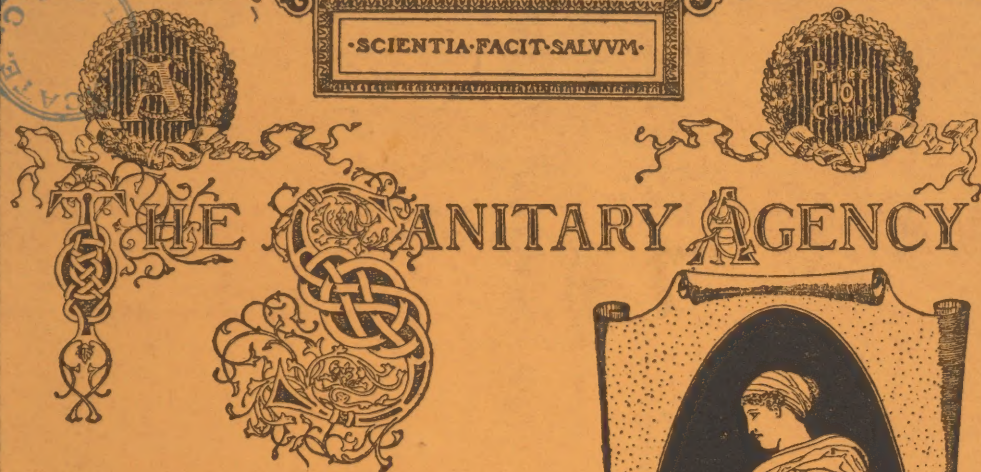


TUDOR (FR.)

SCIENTIA FACIT SALVVM.



A
DESCRIPTION OF
THE PNEUMATIC TEST,

A Scientific Method
of Inspecting

PLUMBING
and
DRAINAGE.

with an Account of Illustrative Cases
met with in Practice.



By Frederic Tudor, Sanitary Architect.

Published by the Agency at its Office,
95 Milk St. Boston.
1893.

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Sole Proprietor of the
Pneumatic Test.

Frederic Tudor,
MANAGER.

374
Process and Apparatus
Patented, 1884.

ADVERTISEMENT.

The Sanitary Agency is the sole proprietor of the Pneumatic Test, and undertakes the inspection of buildings, giving a full report upon their sanitary condition.

The terms of the Agency for conducting an inspection depend upon the difficulties encountered. An ideal case of great simplicity, where everything is in perfect order, costs \$20, including a report. Ordinarily the cost is from \$25 to \$30. Persons ordering the test will save expense by giving the Agency full information as to the accessibility of the open extensions of the pipes on the roof. The inspectors are provided with very complete appliances for reaching pipes on any part of a roof, but do not ordinarily fetch them unless notified that they may be required.

The Agency arranges to REPEAT TESTS each year at a greatly reduced price, and when several neighbors form a club to have an annual inspection made with verification by the Pneumatic Test, the price is still further reduced.

SPECIFICATIONS.

Those who intend to have plumbing work done, either new work, alterations, or repairs, are advised to obtain a copy of our *General Specifications*, for sale at our office, or sent by mail, price \$2.00. These, if followed, will insure good, substantial, proper work, and avoid all dangers incident to plumbing when unskilfully designed, or constructed contrary to the rules established by the best practice. The *Specifications* are copiously illustrated by diagrams and woodcuts, forming, in fact, a concise treatise on plumbing.

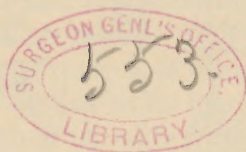
REPORTS.

After inspection a full report is given which is a statement of the exact condition of the entire plumbing apparatus. It is not merely a criticism of the apparatus, consisting of a tedious description of fixtures, etc., but states at once the defects, if any are found, classified under the separate heads of Design and Workmanship, and enumerates the alterations and repairs required, if any, making the latter more clear by sketches if necessary. The reports are models of brevity and clearness.

THE PNEUMATIC TEST.

BY
FREDERIC TUDOR.

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1893.

THE PNEUMATIC TEST. (See page 6.)

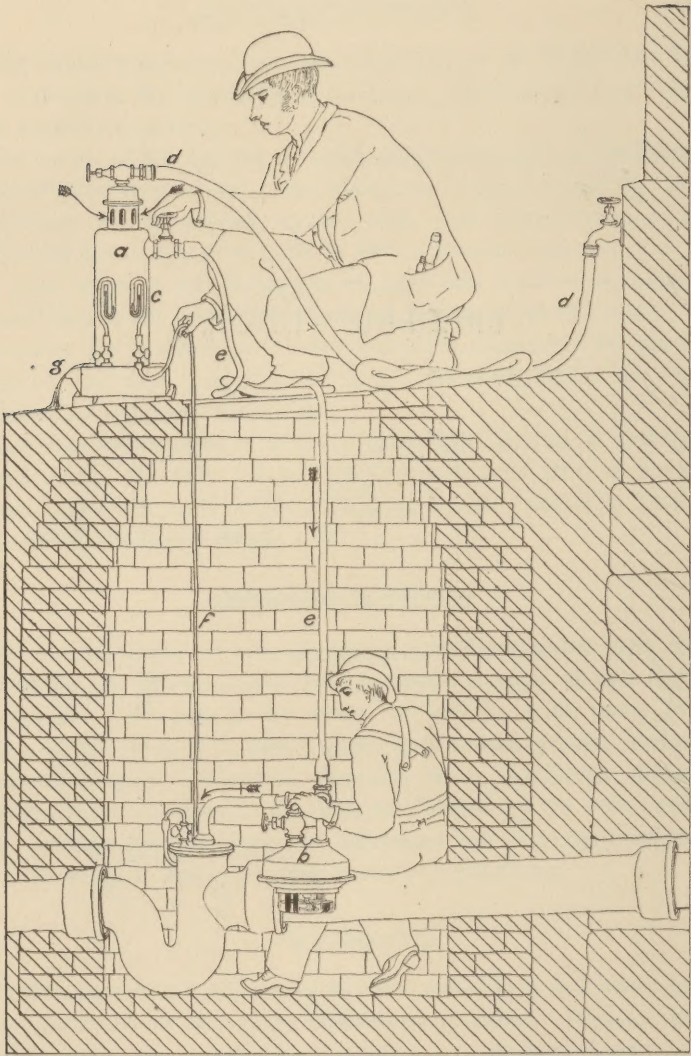


Fig. 1

EXPLANATION. *a* is the air-pump; *b*, the peppermint canister; *c*, the manometer or pressure gauge; *d*, hose supplying water to work the air pump; *e*, hose conveying air to drain; *f*, hose transmitting pressure to manometer; *g*, outlet for spent water and relief trap for discharging surplus air.

THE INSPECTION OF PLUMBING.

Perhaps comfort is a better friend to disease than hardship is. At any rate, a large proportion of the diseases of man are diseases which thrive upon his attempt to live above and in spite of the laws of nature. As if that were possible! Man pretends to be proud of his civilization, being blind and foolish, and not understanding that his civilization is but an artifice of nature to prevent over population. Civilization, culture, and refinement ought to be the means to an end, but man has always mistaken them for the end itself, and perishes in a slough of materialism. In nothing is our disregard of the laws of nature more evident (to those at least who will stop to think about it) than in our construction, arrangement, and use of the house. Primarily, of course, this is a shelter from the elements, from excessive heat and cold, and wind and wet. By the perfection of artifice, we have created domestic life, that is, artificial life, hot-house life, and have made the house a world in itself shut out from the life-giving sun and life-sustaining air. Much more than half of the diseases of mankind are diseases of the house, diseases which thrive upon the absence of light and air, and upon the infections which take their place. For example, in Boston all the best houses are built over a buried morass, without adequate precautions to exclude the gases arising from the decomposing mud beneath. Added to this perpetual malaria is a careless construction of drains in an artificial soil which has not yet settled to its final permanent level. Bostonians abuse their climate! Forsooth, they don't live in a natural climate, but in the artificial noxious climate of their own houses, a malaria just as certainly existent as that of the Campagna; they fall sick in it, and then lay the blame on the climate. There is just as good air in Boston as can be found in any populous locality, and in point of climate it has many advantages, the only disadvantage which the writer is prepared to admit being the prevalence of severe wind and dust-storms in winter. The much-abused East winds, on the whole,

are a blessing, the air being perfectly pure and cool and *dry*.* They may be and probably are a shock sometimes to the being who has become depraved by subsistence solely upon the stewed malaria of a Back Bay house, but it is pretty certain they never made a well man ill. It is the foul, tainted air within the houses which, by repeated attack upon the throat or lungs, or by infecting the blood with malaria, undermines health, and sometimes spreads misery and mourning right and left. This is not the act of God, it is the direct consequence of foolishness and carelessness of the victim or of the people who are responsible for his welfare.

It is a dangerous thing to bring a sewer into the house, into the sleeping chamber. If it must be done, then let the occupant be on his guard and leave no point undefended. But who thinks of it? No one, hardly; yet every one should. Every occupant of a building should know of his own knowledge or have assurance from some one who ought to know that the drainage is perfectly safe.

The owner of the house should be certain of it, because, if he is the occupant, he is responsible for the welfare of his family. If he is the landlord and lessor, he should be certain of it, because if he states that it is so as a fact, when it is not, and his tenant's health should be injured, he will become liable to him in damages. This is an important law which should be well understood, because a case might arise where the illness of the tenant might, in fact, have had another cause. If the landlord cannot prove this (and it is pretty sure to be beyond the domain of proof), and on the other hand the tenant can show that the defective drainage would be an adequate cause, then he can recover in damages.

The tenant should be certain that the drainage is perfect, because no man should enter into and inhabit any building which he does not know to be perfectly healthful, and he has a right to insist that the shelter which he buys for his family should be not only four walls and a roof to keep out the rain, but a shield against discomfort, and a

*This is proved by unquestionable meteorological evidence.

certain barrier against disease. In short, the occupant of every house should have assurance that the drainage is perfect. The only safe way, when it is a question of plumbing, is to get and know the facts, not to rely upon appearances, or opinions, or reputation of plumbers, or tests with peppermint, or any conjecture deduced therefrom, but upon nothing short of concrete demonstrated facts.

Are the pipes properly proportioned, the fixtures suitable, and the work well arranged? That is a matter of opinion, and an expert can give it. But is the work well done? Are the pipes and traps safe? And are the joints all tight, without a single fissure or pin-hole for sewer air to enter? These are questions that can only be answered after an actual trial of the pipes and joints. No plumbing work should ever be put to use until it has been tried and proved to be perfectly tight *under the actual conditions of use*.

In the following pages will be found a concise account of an original and perfect process of trying or testing complete systems of plumbing apparatus, with examples which illustrate its efficiency and show plainly enough that the process, "THE PNEUMATIC TEST" (patented), is beyond comparison superior to any other aid to inspection, and the only one which develops all the facts. As to the plumbers' tests, it is a common remark of the householder that one is at the mercy of plumbers; if they are asked to examine the drains, they come in and go all over the house in a mysterious, solemn way, there is a strong odor of peppermint, and they announce that the pipes are all out of order, and that the only safe way is to replace the whole apparatus with new modern work. It is done; and six months later, if another plumber is invited to give an opinion on this very same new plumbing, there will be the same odor of peppermint, and the same advice to rip the pipes all out.*

The truth is, that the plumber's method of testing is worse than worthless, because it is misleading. He is as

* See the case of A— F— M—, page 19.

apt to get the odor of peppermint with a perfectly good job as with a bad one, and some plumbers who are not strictly conscientious do not hesitate to produce the odor anyhow and scare the householder into giving them a job of work, while the fairly honest man will give his trade the benefit of the doubt, and advise new work as the only guarantee of absolute safety. This is the general result of asking a plumber to report upon the condition of the traps and drains in any house, so much so that people are actually afraid to admit that they have any doubt about their plumbing, and go on simply hoping that the accident of sickness will not strike in their individual household.

Have the public, then, any safeguard in this matter? Is there any means whereby the suspicion and doubt which all refined people feel respecting plumbing may be replaced by confidence and positive knowledge?

Many who read this pamphlet will be surprised to learn that there is a method of testing drains, which, by steady growth, beginning as long ago as 1875, was finally perfected and patented in 1884, and has since that time been practised in Boston and vicinity with unfailing success and gratification to its patrons. In the last year named (1884) there was held in Brighton, England, an exhibition devoted wholly to hygienic and sanitary subjects and apparatus, where the merit and value of this process were considered so exceptional by the committee of awards that a special gold medal and diploma of honor were created for it, ranking it above all other exhibits whatsoever.

In order that scientific readers, physicians, and others to whom this subject is one of special interest, may have a clear understanding of this process and of its usefulness and merit as compared with all other processes, it is thought best to lay before them somewhat in detail a description of the apparatus employed and the mode of applying the test and ascertaining the condition of the drains by its means. In the first place, it is only just to state that the first conception of the process and its

gradually developed perfect adaptation in all its details to its purpose are wholly original with its inventor, the writer, by whom it has been constantly made use of for nearly fifteen years under all possible conditions. The process has been widely imitated by plumbers and experts, but never in its entirety; parts of the apparatus, which are indispensable to accurate results, have never elsewhere been employed, and are here described for the first time. The proprietors are unwilling to admit that the process, simple though it be, is capable of intelligent use except by trained and experienced persons. This is why other experts condemn an imperfect job outright; they are unable to specifically locate the imperfections or to determine whether they are remediable or not; they are forced to condemn as a whole what they have evidence to show is defective in part only. With them the mere existence of an undetermined defect becomes the basis of a conjecture that all is wrong. If there happens to be an imperfect link in a chain, and this link can be detected and be repaired or replaced, then the chain can be made good throughout and the expense of a new one which would be no better, and which itself might be defective, will be saved. This is what the Pneumatic Test does in plumbing work: it infallibly discloses all defects, or demonstrates to a certainty the perfect condition of the apparatus.

THE PNEUMATIC TEST.

The apparatus required for making the test comprises the following things: movable plugs (Fig. 2) for closing the open

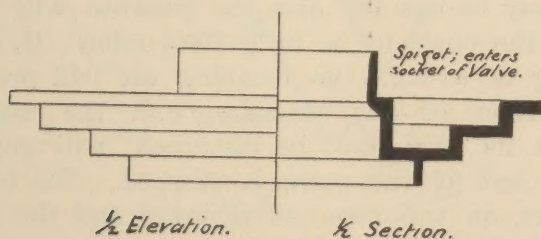


Fig. 2.

ends of pipes exterior to the building ; an air-pump having a capacity three or four times greater than a gas-fitter's testing pump, or, much better, a trombe,* operated by water supplied by a garden hose ; a canister packed with cotton waste moistened with oil of peppermint, so constructed that it can be placed in circuit with the pump and pipes without escape of the odor except into the latter ; a large relief trap, for each open end, forming a temporary water seal of adjustable dip, usually set at about one half inch, and large enough to relieve the system of pipes and traps within the house of pressure in case any fixture should be discharged while the test is being made, and thus prevent any trap being forced or siphoned out ; a manometer ; clay or putty for closing leaks around plugs ; tools, such as screw-driver, hammer, Stillson wrench, etc. The relief traps can be replaced by carefully fitted check-valves (see Fig 3) or McClellan automatic vents, and in case the trombe is used, the oil canister may be replaced by an atomizer operated by vacuum instead of pressure. Two or three persons are required to make the test, the application of which is as follows :—

The soil-pipe and trap-vent pipe extensions above the roof, and the fresh-air inlet at the foot of the system, are all closed, first selecting one to which the air-pump is attached. To this is also attached the peppermint canister, a relief trap, and the manometer (see Fig. 1).

Air is now pumped in, when, if the drains are tight and the traps are in order, the existence of pressure within the system, due to the accumulated air, will be made evident by the manometer. If everything is all right, the supply of air may be cut off, and the pressure will not fall, proving the pipes to be in perfect order. If, however, anything is wrong, the escaping air will prevent the accumulation of any pressure, and the manometer, although its level may be disturbed, will quickly return to zero if the pump is stopped. The temporary plugs are, in this case, all removed and the pump is kept in motion till the odor of peppermint appears at all

* For an explanation of the principle of the trombe, see Ewbanks's Hydraulics

2 INCH VACUUM VALVE.

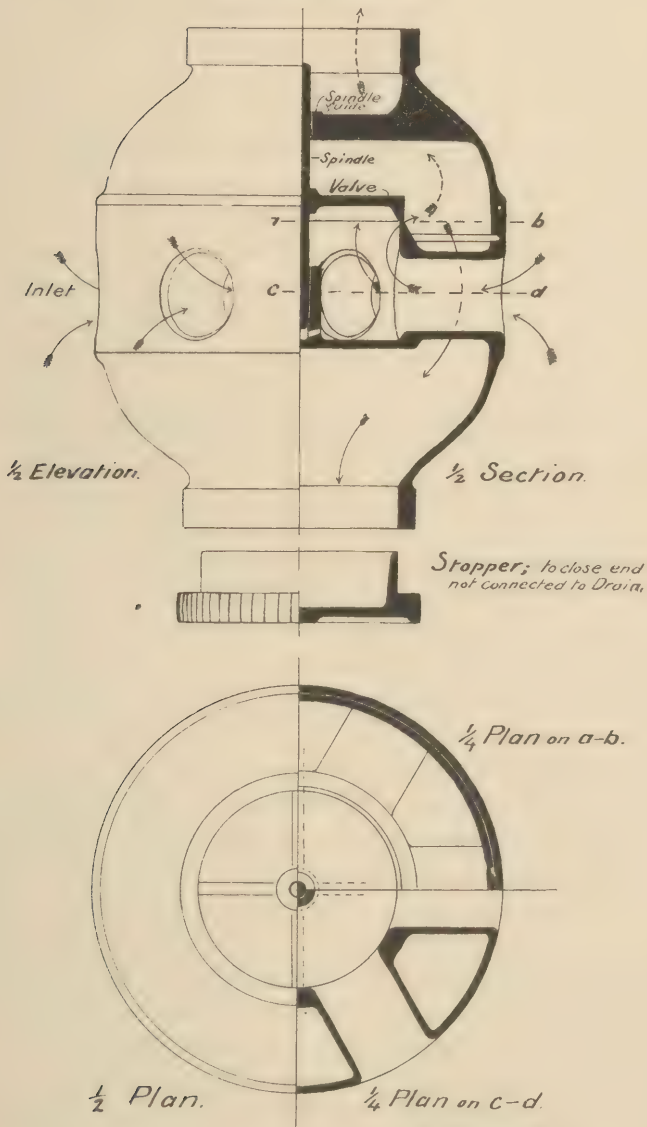


Fig. 3.

J. Tudor, Inv.
1893.

the open ends, which are then closed again, and pumping is kept up till the odor carried along by the air escaping from some leak is detected within the house. This is traced up and temporarily stopped with putty. If it is the only one, the manometer will promptly manifest it; if not, pumping is continued till all the leaks, one after another, are traced up, marked, and temporarily stopped, and until a pressure can be established which is retained even after the pump has ceased to work.

An assistant, meantime, has been preparing a schedule of the leaks as they are revealed, noting their location and description, which is afterwards used as a guide by the repairing plumber, who checks off each item as soon as it is completed, until he has gone through the whole list, and the entire system of pipes has been thus put in perfect repair.

It will be seen that the process is both analytical and systematic. It develops all the facts and avoids all confusion. It also gives valuable assistance in tracing out old lines of drains and disused connections, such as are apt to exist where alterations have been frequently made.

Compared with this rational and practically perfect system of testing, what other system is there which merits a full description?

The water test, some one says. But it must be remembered that the water test is not practically applicable to a system of pipes after it has passed into actual use without great inconvenience, expense, and risk of damage to the house by escaping water. It is limited in application to new work, must be applied before any interior finishing or decoration has been begun, covers only part of the ground, and does not in fact test the integral system of pipes and traps when completed for use. This is fully appreciated by many architects, whose custom is to require the Pneumatic Test to be applied to all finished new work before accepting it.

In another aspect it may be objected that the maximum pressure employed in this test is too feeble to be of any practical value, being equivalent to a column of water

only three quarters of an inch high, or one thirty-sixth of a pound per square inch. In reply to this, it should be pointed out that this pressure, slight as it may be, is yet many times greater than any pressure which can be put upon the pipes and traps in actual use. If a bridge will carry safely a train of locomotives weighing five hundred tons, it will certainly carry safely a train of cars weighing only one hundred tons. It is not necessary to require a proportionally severer test than this, and by analogy, if the drains are proved to stand with success a pressure of three quarters of an inch of water, they are certainly perfectly safe under a pressure of about one eighth inch, which is about the maximum realized in actual use. Theoretically, there should be no pressure whatever, but this is hardly attainable, at least not at those times when the pipes are flushed by the discharge from some fixture.

One feature which should not be lost sight of is the fact that this test can be applied without interfering in any way with the regular use of the plumbing apparatus by the occupants of the building.

Unfortunately in most cases a great deal of time is lost in getting access to the pipes on the roof. They are often so placed as to require temporary scaffolds in order to reach them, giving the inspectors some risky climbing to do. Then old unfit work, such as catch-basin traps, are frequently combined with new work, and the pressure is lost through the old joints of the masonry. Where work is properly constructed and if it is in good order, the test can be completed in about an hour, but this happens almost never. Owing to the inaccessible location of the outlets, and the unsystematic way in which plumbers lay out and connect up their work, often two or three hours' time is consumed simply in getting ready, when, in perfect work, less than one minute suffices for completing the test. The most difficult cases are those which combine inaccessibility of the outlets with complicated or obscurely located branch drains and imperfect joints, making a great number of leaks to be traced up; such cases sometimes use up a day or even a day and a half of the time of three

persons accustomed to the work. This, however, is much cheaper than condemning the whole apparatus, as is the usual custom, because the inspector is unable to find out what the matter is, when it may be that after all only a few trifling repairs may be required. Even if it should prove that the drains are seriously defective, it is better to know exactly what the defects are, and act with full knowledge of the facts ; there is no satisfaction in guessing in matters of this sort.

To more effectively illustrate the kind of facts which are developed by this process, and the convincing way in which it replaces doubt, supposition, and error by positive knowledge, a few examples are quoted from experience obtained.

A FEW CASES.

HOUSE OF J—— G——. The owner was urged to have the plumbing renewed by a prospective tenant, a physician, whose suspicions were doubtless aroused by the fact that some of the fixtures were old-fashioned. The test, although completed with difficulty, showed everything within doors to be in perfect order, except that the hand-hole plate on the running trap had never been properly fastened down, also that in the yard there was a leaking cesspool trap, neither defect being of much importance.

SIX YEARS SUBSEQUENTLY. Another tenant demanded an engineer's certificate. Inspection showed that the former tenant had gained his wish and the old-fashioned fixtures had been replaced by modern ones. The test revealed every one of three new water-closets to be very imperfectly connected to the soil-pipe ; in one case, the calking lead did not even fill the socket (Fig. 4), and it had always been a dangerous defect from the day it was finished. These leaks were repaired, and the work was then found as a whole to be perfectly tight, showing there had been no depreciation in the original work after six years' use.

HOUSE OF MRS. W—— E——. Inspected by plumbers three months previously, who said they left everything in order. The owner declared that the odor of peppermint hung about the house for a week after. The Pneumatic Test revealed a half-dozen imperfect joints in the main horizontal, a bad joint in a third story branch,

three leaking trap screws, and a hole in the kitchen sink waste-pipe; the latter having been "burnt"; by a too hot soldering iron when originally put in place,—a dangerous accident, but fortunately

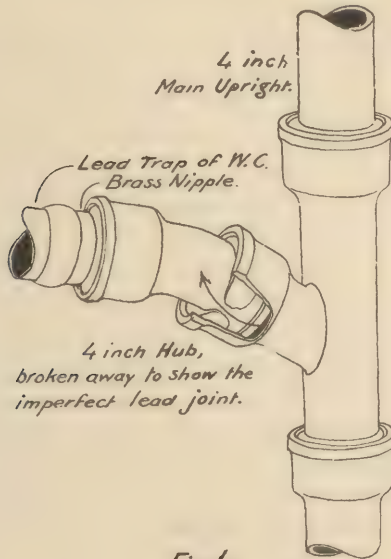


Fig. 4.

rare with careful workmen. The peppermint test failed to reveal the latter mentioned serious leak, because it was not on the main line of soil pipe, but was cut off from it by a grease trap. The peppermint went off by the main line. Yet the kitchen branch was connected to the main by a $1\frac{1}{2}$ inch back-air pipe, and sewer air could flow freely from either to the other. See the case of A——A——H—— below. Such instances as these are proof of the unfitness of the peppermint test. It ought not to be called a test at all.

R——F——. A summer and health resort in a wealthy town. In the summer of 188— a prominent citizen died in the hotel of typhoid fever, there being other cases of sickness besides. The drainage being suspected, the establishment was speedily abandoned by nearly all the guests. Thereupon, at the request of the proprietor, the local Board of Health, consisting of three persons, of whom two were physicians, inspected the house, and gave him a written certificate signed by them, and stating that they had inspected the premises and found the drainage and sanitary conditions perfect. The owner, to save, if possible, the reputation of his house, desired

to re-enforce this opinion by the testimony of an expert, and ordered the Pneumatic Test to be applied. The result showed that a five-inch elbow at the base of one of the upright lines of soil-pipe had never been calked; that in one of the other lines a number of calked joints had been destroyed by the action of steam, in one case the ring of lead being quite out of the socket and hanging loosely around the pipe; that the meat-rooms and refrigerators drained directly into the soil-pipe through common bell traps. Everything was repaired and made right throughout, and proved to be in order by a final test. The house, however, only partially recovered its good name, and shortly afterwards and in the middle of the season was closed, in which state it remains to this day.

BUILDING OCCUPIED BY THE BOSTON BOARD OF HEALTH AT NO. 12 BEACON STREET. Test made in 1889. This and the adjoining house and a connecting building in the rear had been recently purchased by the city. New plumbing had been put in under the direction of the city architect, and in supposed accordance with his specifications, which required each building to be treated separately, supplying an independent iron drain, and a main trap with air inlet, all to be connected to a new underground iron drain extending to the sewer.

The test was desired by Dr. Durgin, the chairman of the Board, to be an object lesson to the inspectors, in which respect it did not prove wholly successful, for the reason that the inspectors looked for an immediate revelation of the condition of the drain, with a detailed explanation from the testing party. They had themselves exhaustively tested the house by pouring quantities of oil of peppermint into the top of the pipes, repeated during several previous days, and, not detecting the odor of the oil within doors, had pronounced the drains O. K.

At the outset of the test made by the pneumatic apparatus it was discovered that all three houses had to be tested as one; the venting of the pipes had been so unsystematically carried out that about two hours were spent in tracing them out and closing them. Finally, when this was done and pressure was applied, the manometer indicated loss of air by leaks in the system, which fact was duly announced to the inspectors as being evidence that the drains were not tight. Unfortunately for the test, there was no odor of peppermint within the buildings, and as the test did not establish instantly the location of the leaks, the inspectors shortly left, evidently with a poor opinion of the process as compared with their own, which con-

sists simply of pouring peppermint into the pipes and then trying to detect its odor within the house. Such a test can establish nothing more than a probability, for it can readily be shown that the conditions must be extremely bad if the odor can escape into the house in the absence of all pressure within the pipes. In the case of the test under consideration, parts of two days were consumed before all the facts were revealed; these proved to be that the main iron drain and the separate main traps had all been omitted (*i. e.*, “skinned out of the job”); all three drains connected without traps into an old system of brick drains with several branches extending to catch-basins, through whose numberless joints the air escaped before any pressure could be established. The only leak found and located was at the connection of the boiler blow-off to the old drain above referred to, the odor escaping freely into the house at that point, although the pressure applied was so slight as not to be indicated by the gauge, which is very sensitive. It is not known what other leaks might have been discovered had the full pressure been employed, which, however, was not practicable, owing to the bad condition of the drains. The failure of the peppermint test in the hands of the inspectors was chiefly due to the existence of a hot flue connection, which is and was at that time illegal (we are speaking of the official residence of the Board of Health of the City of Boston), which, of course, the imperfect process relied upon by the officials failed to detect, and which they knew nothing about. It may fairly be claimed in this case that the test revealed a state of things which could not have been established in any way short of digging up the whole system, and which but for it would have remained a perpetual secret with the rascally plumber who scamped the job, and the inspector who permitted it.

On the other hand, the Board of Health test revealed nothing, except that, relying upon it, the Board’s own inspectors were misled into pronouncing the job all right.

Here are two cases which are interesting by contrast, the test in each case showing the exact contrary of what was expected:—

HOUSE OF T—P—. An old house with new plumbing was offered for rent. The new tenant, a well-known architect of large practice, for reasons satisfactory to himself, one of which was that he knew the plumber, would not sign papers until the plumbing had been thoroughly tested. The Pneumatic Test proved everything to be perfect both in arrangement and operation.

HOUSE OF C—A—. In this the entire construction, from

foundation to ridgepole, was carried on under the personal supervision of the owner, a wealthy manufacturer of large experience. His oldest son had died in the house of typhoid fever a few months previously. The reason for applying the test, however, was the fact that the house was to be let, and the lessee, F—— L—— A——, demanded inspection before occupying it. The plumbing was “one of ——’s best jobs.” Neither the owner nor any member of his household had ever suspected for a moment the possibility of imperfections in the drains, and the first statement that the test indicated serious defects was received by all with incredulous surprise. The owner was sent for from his office by a member of the family, and he arrived in what may be well enough described as “a state of mind,” and began to express himself very freely, evidently supposing the inspectors were merely giving an opinion about a mat-

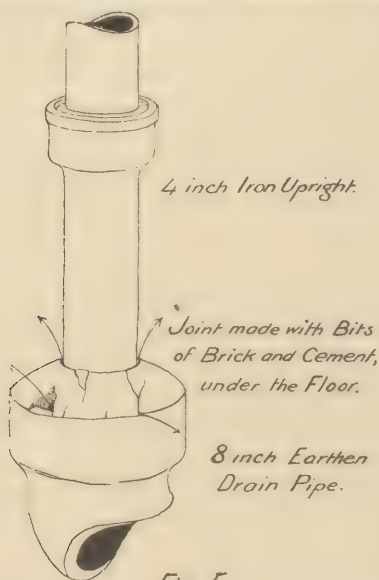


Fig. 5.

ter concerning which they could know but little. While he was still talking, the inspectors had exposed one of the defects, the character and danger of which were at once explained to him. He listened without a word and went away in silence, appearing to have been quite stunned by the shock of the discovery. Money could not measure the value which the knowledge then obtained would have been to him had he had it a year previously. The test showed that all the vertical lines, under the effect of expansion and contraction, had separated from the main horizontal (Fig. 5), and the latter to be

of such a character that it had to be entirely replaced by new work. This house, although new, had been in a dangerous condition from its completion.

COUNTRY HOUSE OF H—M—W—. Although the owner had sickness in the house during the latter part of the summer, the Pneumatic Test was ordered more with the view to furnish corroborative evidence of the plumber's statement that "everything was all right," than with the expectation of finding any plumbing defect to which the sickness could have been attributed.

Inspection showed an extremely bad leak of sewer air in the laundry. Here was a large grease trap serving both laundry and kitchen (Fig. 6). A terrible stench came out of the waste pipe of the

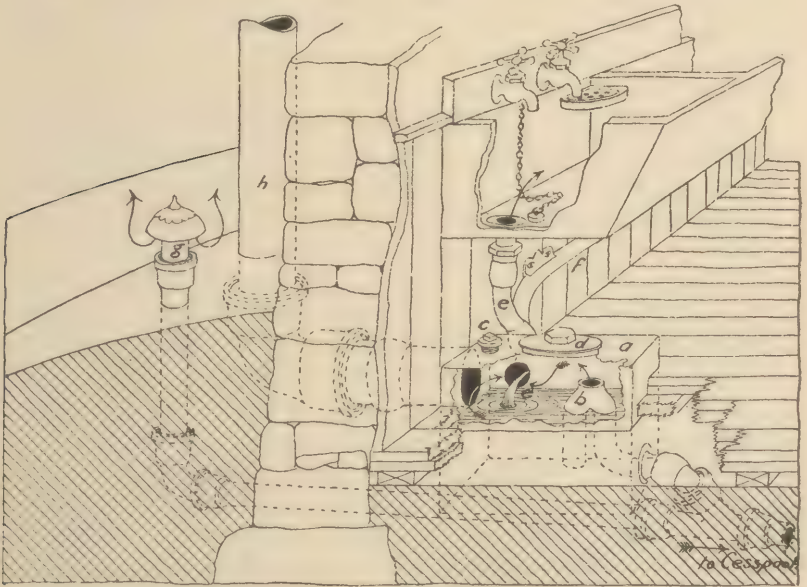


Fig. 6.

tubs, which emptied into the grease trap. A large trap-screw or clean-out on top of this was removed, when it was found that there was a four-inch vent pipe connected to the top of the trap and that the laundry and kitchen waste pipes both entered it above the water line. Consequently, there was nothing to prevent a current of air from outside flowing into the house through the four-inch vent pipe, over the putrid grease in the trap, and thence into the house through the laundry-tub waste-pipe, except when the latter was closed by plugs.

This was not all. The grease trap contained within it a stench trap formed of a half S lead trap upside down. The brass clean-out screw belonging to this had been removed and laid one side. Whether this was an act of carelessness or of confusion of mind on the part of the plumber, who might have had an idea to thereby improve the circulation of air, could not be determined, but there was no doubt about the effect. This was to make a direct untrapped connection between the cesspool and the house. The inspector asked the laundress if she had not been annoyed by this stench during the summer, and upon her replying yes, asked why she had not reported it. Her answer was, "I did, indeed, sir, but Mrs. W—— told me that the plumbers had cleaned out all the traps and pipes in the spring and had left everything in order."

The missing screw was replaced and the test completed, showing everything to be in perfect order. Advice was given, however, to abolish the complicated and dangerous grease trap and its appendages.

The following is an unusual case,—unusual only because it was that of one of the best built houses in the best location in Boston. It may be found commonly among the cheaper class of block-built houses in certain parts of the city:—

HOUSE OF D—— A——. Every detail of construction of this house which had a bearing upon health had been most carefully attended to. After painstaking inspection the plumbing appeared to be perfect. The only questionable thing was the duct for cold air to the furnace, which was built up against the foundation party wall, which formed one side of it. The latter was built of Roxbury pudding stone, with joints only partly filled with mortar. On the other side of this wall there lived a distinguished physician, and the possibility of a defect here was not suspected. However, on testing the drains in the physician's house the odor of peppermint promptly appeared at all the hot-air registers in the house of D—— A——, having entered by way of the party wall and the furnace cold-air duct. The doctor gave the order for the immediate renewal of all his drains; but the only child of D—— A—— had already been dead some time.

HOUSE OF W—— M——. Country plumbers' work. There had been sickness in this house, followed by the death of the owner and one of his children. Those who remained desired to be reassured that the plumbing was all in order, having previously had entire

confidence in the judgment and careful superintendence of their late *paterfamilias*, a practical man of wide knowledge, and a successful manufacturer.

The test showed what no ocular inspection would have detected without uncovering all the pipes, and tracing out each one, and accounting for each connection, and what no test short of the pneumatic would have revealed positively. A receiver vent-pipe, apparently extending above the roof, had been connected to the main soil-pipe, where such a connection would have been least expected. The condition was that the drain was open into the house through the w. c. receiver, in which there was a vent opening, and another small one for the passage of the handle.

The "peppermint test" would have disclosed this defect only in the event of there being a strong indraft into the room. The Pneumatic Test is independent of such accidents.

HOUSE OF A——F——M——. An old house, had not been occupied for several years. The new owner, before making alterations, sent a plumber to report upon the condition of the pipes. He poured some peppermint into them and reported that they would require to be renewed throughout at an expense of about \$1,000. To be doubly sure, the owner sent another plumber, No. 2, with instructions to examine and report. His recommendations were substantially the same as those of No. 1. In the mean time and before deciding upon making these radical alterations, which seemed to be called for with such unanimity, the owner heard of the Pneumatic Test and ordered it to be applied. Inspection made by its aid showed the whole system to be admirably arranged and constructed and to be in perfect working order and repair.

HOUSE OF A——A——H——. Alterations had been made in the drainage of this house subsequent to the application of the peppermint test. A recurrence of diphtheria in the family aroused the suspicions of the attending physician that there remained undiscovered defects, but a new application of peppermint gave negative evidence, and finally the Pneumatic Test was resorted to.

This house had two sewer connections, one in front with a main trap, and another to a private sewer in the rear, untrapped; both systems were united before reaching the roof to the four-inch upright, the junction being effected through the back-air pipes. Now, when peppermint was poured into the main pipe, the oil followed the main line out through the trapped branch, and the odor was pre-

vented from reaching the untrapped branch by the strong flow of sewer air coming from the private sewer towards the house, consequently the peppermint test completely failed. The scented air of the Pneumatic Test, however, being under perfect control, was forced to follow both branches to both sewer connections, backing down the back-air pipes and driving back the sewer gas in the untrapped branch till it found escape at several open joints and badly packed clean-outs on that part of the system, finally reaching the sewer, and by way of that, the adjoining house, which a test subsequently applied showed to be in a similarly defective condition. In this case the success of the Pneumatic Test was as pronounced as the failure of the peppermint test was complete. But failure in this kind of work cannot be tolerated, a single instance of it being sufficient to bring total condemnation. What we must have if we can get it, is positive, not negative, evidence. In matters affecting health and life we don't care to be guided by conjectures and doubts when facts are within our reach.

A very common defect is shown in Fig. 7. When the

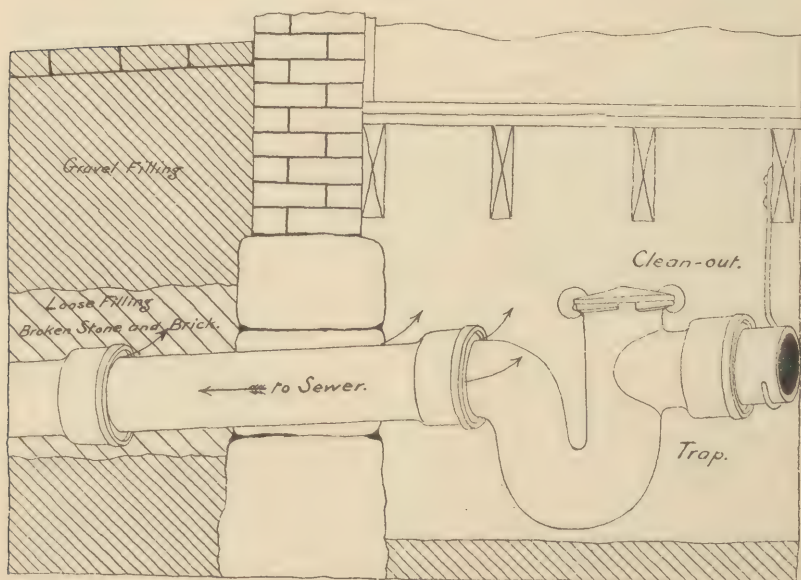
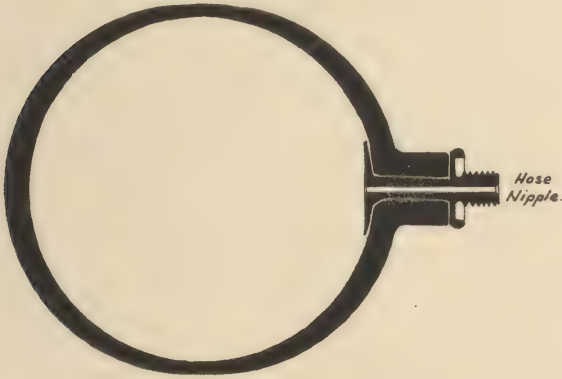


Fig. 7

main trap is placed within the main wall of the house, as shown in the illustration, the house is not effectually insulated from the sewer. If there happen to be defective

joints in the drain between the house and sewer (and there are very apt to be such defects, because these drains are never properly supported), the sewer air will follow along the pipe and enter through the foundation wall. For testing the soundness of these joints the Agency's Engineers use an expanding plug (Fig. 8), which is floated

**4 INCH
INTERNAL PLUG.**



Section.

Fig. 8.

*J. Tudor, Inv.
1893.*

in through the trap attached to a long piece of pneumatic hose, as in Fig. 9, showing the drain laid open, and the plug in place expanded by means of the air-pump. The drain is then filled with water up to the top of the trap, when, if the joints are tight the water will stand at that level, but if there are leaks, it will settle away. It is possible with this apparatus to locate a leak with absolute exactness. It is permitted by the law to place the main trap within the house as shown in Fig. 7; but in the opinion of the Agency, this is a very serious blunder, and the Agency does not issue certificates for houses so arranged. The right method is shown in Fig. 1, where the main trap is in a vault entirely separated from the house. This construction requires special arrangements for ventilation which are not shown in the illustration.

In justice to the proprietors of the Pneumatic Test, an account of it ought not to be concluded without contrasting with it the plumbers' method of saturating everything with oil of peppermint in their so-called tests, and a statement of what the process is in their hands. It consists simply in the unstinted use of oil of peppermint. The writer knows of one case where ten pounds of oil of peppermint were poured into the pipes, quantities of it getting on to the hands of the men or their clothes. The plumbing foreman who stood by and saw this done, when arraigned by the writer for permitting such clumsy work and for throwing away nearly \$40 worth of a costly essential oil into an old drain without result, defended himself by the statement that forty

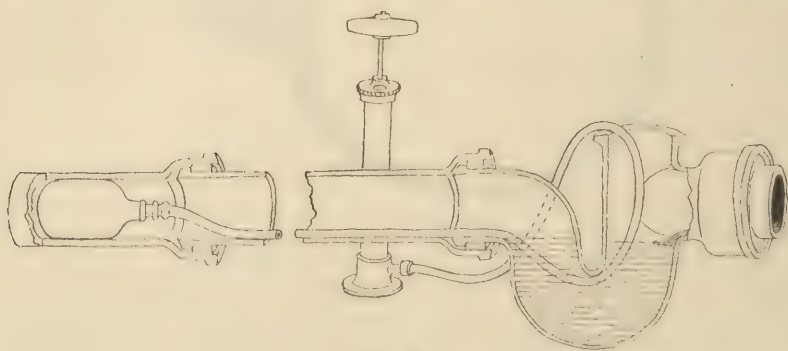


Fig. 9.

pounds, worth \$160, were used in testing the drains of Mr. Vanderbilt's house in Newport. The writer forbears to make further comment on this than to say that in his entire practice, covering fifteen years, he has not used so much as five pounds of the oil altogether. In new work the amount which is volatilized is only a small fraction of an ounce. It is never poured into the drain.

In the city of Boston the Board of Health is willing to make tests of plumbing without charge on application by any occupant of a lodging or tenement house, and is frequently appealed to by lodgers and tenants, who want a disinterested opinion. The test made by them is simply the plumbers' test above described, with the difference

that the Board's inspectors do not take any precautions to prevent the odor of the oil escaping within the house from other sources besides the drain, that is, from their handling of it. They are careless about this, and after opening the oil, pretend they can discriminate whether the odor reaches their nostrils directly from the bottle or by way of the drain. Even the peppermint test, properly applied, requires two persons (the Board's inspectors always act singly), and it is the custom with plumbers to have at least two persons make the test, yet even they do not take adequate precautions to avoid accidental escape of the odor of the oil. A large part of the elaborate apparatus employed by the Agency in testing is, next to its labor and time-saving quality, largely designed to prevent all chance of any peppermint escaping anywhere except through leaks, thus imparting the quality of certainty to the evidence obtained. In cases of satisfactory tests, no odor of peppermint is noticed anywhere when this apparatus is used.

The peppermint test had some value before the adoption of the main running trap and the soil-pipe extension above the roof, constructions which are now quite general, and exacted by the plumbing ordinances of most well-regulated municipalities. Where these essentials are not found, there is commonly, but not always, an indraft from the sewer, caused by the aspirating action of the chimneys, and where pronounced defects exist in such cases the common peppermint test may reveal them, except when the condition prevails which is explained below. In the case of modern work, however, there is usually, but not always, an outdraft, since the soil-pipe extension itself acts as a chimney, when the peppermint test can show nothing. So, too, where the drain has no main trap, and there is no soil-pipe extension, the effect of the sun or the wind on the rain-water leaders may create in them a powerful outdraft, sufficient to protect the house for the time being from all sewer air, and prevent the discovery of all defects, although extremely bad ones may exist. There are thus occasions under which

the peppermint test gives only negative results, even in the presence of the worst conditions. These remarks are equally applicable to the smoke test. It was to obtain positive results under all circumstances that the Pneumatic Test was invented, and it hardly needs further demonstration to show that the ordinary tests, even the official tests of the Board of Health, are practically worthless except occasionally, when the defects are extremely bad, and the conditions favorable for the test. In other words, such tests give results by accident, and are, therefore, untrustworthy.

NOTE. Since the last edition of this pamphlet was issued, the Sanitary Agency has inspected 21 new buildings, all of the best class, and having the latest style of "open plumbing" with expensive fixtures. They were all designed and superintended by leading architects, located in aristocratic neighborhoods and passed as perfect by the official inspectors using the water test.

Of these houses only one was free from defects, i. e., did not leak sewer air, and even this was defectly designed in the respect of having the main trap within the cellar wall; one was found to have a branch from the soil pipe behind marble work left entirely open, and all the others leaked sewer air to a more or less serious extent. If less than 5% of the best new houses are found to be perfect, what is the probable condition of those less pretentious?

THE SANITARY AGENCY ENGINEERING DEPARTMENT.

The Agency furnishes designs, plans, specifications, and superintendence of all branches of sanitary construction, including, besides plumbing and drainage, steam and water heating and ventilation, and in the case of new work acts jointly with the architect. This department, as well as that of inspection, is under the direction of Mr. Frederic Tudor, who, as sanitary architect, was employed by the trustees of the New Public Library, and by the city architect in the cases of the Roxbury High School and the Long Island Hospital. He has had charge of other public and private works of importance throughout the country, especially in New York and Albany, to which recommendation he adds the knowledge gained during twenty years' experience in the practical construction of sanitary apparatus in all its branches.

CONSTRUCTION DEPARTMENT.

The Sanitary Agency, in co-operation with a first-class plumbing house, carries on the work of plumbing, especially in the line of repairs.

Where patrons employ a plumber regularly, the Agency prefers not to interfere to his disadvantage, and will aid him in the prosecution of his work; if, however, employers have no preference, the Agency will gladly accept orders. It is the custom of the Agency to test its own completed work, and, after it has been proved to be in perfect order, to deliver to the owner a certificate to that effect without extra charge.

REFERENCES.

Mr. Tudor, by special permission, gives the names of a few persons which he has selected from among the hundreds for whom he has performed expert service:—

Mr. F. L. Ames.

Hon. Horace Gray.

Mr. Martin Brimmer.

John Homans, M. D.

Rt. Rev. Phillips Brooks, D. D.* Gen. John Newton, U. S. A. Eng'r.

Mr. James B. Francis, C. E.* J. P. Oliver, M. D.

Gen. Francis A. Walker.

Messrs. McKim, Mead & White, Architects.

Messrs. Shepley, Rutan & Coolidge, Architects.

* Deceased.

• CERTIFICATES. •

The Sanitary Agency issues only one grade of certificate, which is assurance that the tested work is at the date of the test in a perfect condition. It is evident that in the matter of plumbing there should not be degrees of safety, yet there may be degrees of excellence of materials and workmanship, or of both, indicating a greater or less degree of permanency. Consequently, the best class of work receives a certificate covering a period of five years from the date of the test, and meaning that, in the opinion of the Agency, the apparatus will remain in the same perfect condition in which it then is for a period of at least five years. We have had experience of apparatus being perfectly good after twenty years without any repairs whatever. Cases where the traps and fixtures are not up to the standard of modern requirements, receive a certificate for one year only. At the expiration of the term a new inspection will be made, if desired, at a reduced rate, depending chiefly upon the time required to make it.

The Sanitary Agency believes that the time is at hand when self-interest will compel the proprietor of every hotel, apartment and boarding-house to keep the certificate of the Agency posted in a conspicuous place, and when without it no summer or health resort can exist.

The certificate of the Agency, when a clean bill of health is given, adds value to real estate, in case of lease or sale, many times above the cost of the inspection.